PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : A01N 37/20 — A1

(11) International Publication Number: **WO 99/13717**

(43) International Publication Date: 25 March 1999 (25.03.99)

(21) International Application Number: PCT/US98/19429

(22) International Filing Date: 17 September 1998 (17.09.98)

(30) Priority Data:

08/932,227	17 September 1997 (17.09.97)	US
08/932,595	17 September 1997 (17.09.97)	US
08/936,188	17 September 1997 (17.09.97)	US
08/936,189	17 September 1997 (17.09.97)	US

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(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published

With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: A DELIVERY OF ARGININE TO CAUSE BENEFICIAL EFFECTS

(57) Abstract

A delivery vehicle and method for delivering, either topically or orally, a nitric oxide releasing substance such as L-arginine 31 into human or mammalian tissue for the purpose of producing beneficial effects such as the relief of pain, the warming of cold tissues, the growth of hair on the scalp, the healing of leg ulcers, the relief of impotence as well as other beneficial effects. The delivery vehicle provides a hostile biophysical environment which facilitates and promotes the migration of the nitric oxide releasing substance into the tissue.

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A Delivery of Arginine to Cause Beneficial Effects

Background of the Invention

Field of the Invention

This invention relates, in general, to a delivery vehicle, either topical or oral, which contains substances including, but not limited to, arginine and L-arginine. The purpose of this delivery vehicle is to introduce arginine or L-arginine into human or mammalian tissue for the purpose of producing beneficial effects such as the relief of pain, the warming of cold or cool tissues, the growth of hair on the scalp, the healing of leg ulcers which are often secondary to diabetes or confinement to bed, the relief of impotence, as well as beneficial effects through the restoration of natural mechanisms based on improvement of local blood supply.

Prior Art

Approaches to improving local blood flow have been many and consist of both systemic and topical approaches. Many beneficial effects could be obtained should improvement in local blood flow be achieved since impairment of local blood flow causes a variety of negative consequences. Among these are cold hands and feet, certain forms of impotence, baldness, and leg ulcers.

The fundamental basis for cold tissue of the hands, fingers, feet and toes as well as other cold tissue is insufficient blood flow to the tissue. It has been suggested by some that increasing blood flow through relaxation of blood vessels, particularly small and very small vessels will warm cold tissue. However, many attempts to warm by use of agents which produce vasodilation and therefore increased blood flow have produced negative results.

Previously cold hands or feet have been treated by wearing warm socks or gloves, sometimes even socks or gloves which are mechanically heated. The use of hot packs and glove or shoe inserts which generate heat through chemical reactions have also been potential solutions. Another method of

treatment is the application of certain liniments which are irritants. These liniments include the red pepper derived substance, capsicum, and its source extract oleoresin capsicum. More recently, topical creams containing nitroglycerin have been used. However, nitroglycerin is a cardioactive drug, and thus its use raises concerns about its effect on the heart. Although all of these approaches may work at one level or another, they are often extremely transient in nature.

Furthermore, it has long been recognized that impaired blood flow to the penis is a major cause of erectile failure (impotence) in men. It has been discovered via *in vitro* tissue culture experiments and various animal experiments that nitric oxide is an important mediator of relaxation of the vessels in penile cavernous tissue. Topical nitroglycerin has been used in the treatment of impotence because of its ability to dilate vessels. However, the results of such treatments have been inconclusive and the treatment has proven to be not well tolerated because of the cardiac response to nitroglycerin.

It has also been recognized that deficiencies in blood flow in the scalp occur in male pattern baldness. Topical minoxidil has been used as an agent for hair growth in male pattern baldness with varying results. The suggestion has been made that minoxidil operates by increasing in the blood supply to the scalp.

Furthermore, there have been many approaches to overcoming pain in the prior art. These attempts consist mostly of oral analgesic agents ranging from aspirin and ibuprofen to more powerful narcotic oral agents such as codeine. Alternatively, in cases where a subject suffers from severe pain, narcotic agents including morphine have been used. It has been found that the amino acid L-arginine is a precursor to the natural endogenous analgesic substance, kyotorphin. It has been shown that intravenous administration of large amounts (30 g/patient) of L-arginine is successful in overcoming pain. It is thought that this treatment exerts its effect by increasing levels of kyotorphin. However, this treatment is impractical for use in everyday life and is reserved only for the most extreme forms of chronic pain. Others have found that nitric oxide, whose biochemical precursor is L-arginine, potentiates b-endorphin-

induced pain relief. Another form of pain relief, which is distinct from the use of arginine, is the application of capsaicin, a substance derived from hot peppers.

SUMMARY OF THE INVENTION

In accordance with the present invention, it has been discovered that the delivery of the nitric oxide precursor, arginine and its derivatives, by either a topical approach, an oral approach or a combination of both, produce a variety of beneficial effects due to the increased blood flow caused by the subsequent release of nitric oxide into the blood. These beneficial effects include the warming of cool or cold tissue, penile erection, restored hair growth and the healing of leg ulcers. Also, according to the present invention, the topical delivery of arginine, when fortified with capsaicin, capsicum or its source extract, oleoresin capsicum, can alleviate pain when administered to a specific area of the body.

In one important embodiment of the present invention, when a delivery vehicle containing arginine or arginine derivatives in a concentration sufficient to produce the desired effects, along with sodium chloride or other salts at a concentration sufficient to produce a hostile biophysical environment, in either a topical form, oral form or a method combining both the oral form and the topical form is applied to a selected area of cool or cold tissue, the tissue is subsequently warmed. The warming of the tissue is caused by the increase in blood flow to the treated area. This warming effect can be prolonged, often lasting from 2-18 hours. In persons with very cold tissue (for example 22 ° C) this warming effect can have a magnitude of 10° C or more.

Another embodiment of the present invention is the application of a delivery vehicle containing arginine or arginine derivatives in a concentration sufficient to produce the desired effects, along with sodium chloride or other salts at a concentration sufficient to produce a hostile biophysical environment, in either a topical form, oral form or a method combining both the oral form and the topical form to the penis to increase local blood flow and concurrently overcome impotence.

A further embodiment of the present invention is the application of a delivery vehicle containing arginine or arginine derivatives in a concentration sufficient to produce the desired effects, along with sodium chloride or other salts at a concentration sufficient to produce a hostile biophysical environment, in either a topical form, oral form or a method combining both the oral form and the topical form to bald areas of the scalp on a nightly basis to promote growth of new hair.

A yet further embodiment of the present invention is the application of a delivery vehicle containing arginine or arginine derivatives in a concentration sufficient to produce the desired effects, along with sodium chloride or other salts at a concentration sufficient to produce a hostile biophysical environment, in either a topical form, oral form or a method combining both the oral form and the topical form to superficial ulcers such as leg ulcers to promote healing through the increase in blood flow to the surrounding area.

Another embodiment in accordance with the present invention is the application of a delivery vehicle containing arginine or arginine derivatives in a concentration sufficient to produce the desired effects, along with sodium chloride or other salts at a concentration sufficient to produce a hostile biophysical environment and capsaicin or oleoresin capsicum in concentrations sufficient to produce the desired effect, in either a topical form, oral form or a method combining both the oral form and the topical form directly to the painful area to overcome pain.

OBJECTS OF THE PRESENT INVENTION

Accordingly, a primary object of the present invention is to prevent mammalian or human tissue from becoming cold prior to entering into situations which induce cold hands and feet such as skiing or other winter outdoors activities by increasing blood flow to a selected area or areas of the body through the use of a nitric oxide releasing substance.

Another object of the instant invention is to provide a means for overcoming impotence by increasing the blood flow to the penis through the use

a nitric oxide releasing substance.

Yet another object of the present invention is to promote the growth of hair on bald portions of human scalp by means of increasing local blood flow through the use of a nitric oxide releasing substance.

A further another object of the instant invention is to induce the healing of superficial ulcers of limbs by means of increasing local blood flow through use of a nitric oxide releasing substance.

Still another object of the present invention is to relieve pain by means of increasing local blood flow through the use of a nitric oxide releasing substance.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

At the outset, it is to be understood that the invention is described in its broadest overall aspects with a more detailed description following. The present invention in one embodiment is a method of delivery of arginine or its derivatives to cause beneficial effects by its release of nitric oxide. The present invention relies on the discovery that a carrier or vehicle for arginine will expel the arginine if it contains, in addition to the arginine, an agent which causes the arginine to leave the carrier and enter the tissue.

THE ORAL DELIVERY VEHICLE

One of the preferred embodiments of the present invention comprises the administration of an oral delivery vehicle selected from the group consisting of orally administered capsules, tablets or liquids containing 200-500 mg of arginine or one of its derivatives, and a concentration of ionic salt such as sodium chloride in an amount sufficient to create an ionic environment which causes the arginine to migrate from the vehicle to the surrounding area.

Another purpose of the present invention is to promote hair growth on bald human scalp when applied to the bald area each night for several months. Hair growth is naturally a slow process. However, substantial hair growth has been achieved over large areas of scalp with results becoming evident in a few weeks and substantial within several months.

THE TOPICAL DELIVERY VEHICLE

One embodiment of the present invention comprises a topical delivery vehicle having properties of excellent absorption into the skin. This topical delivery vehicle contains L-arginine hydrochloride (12.5% w/v), choline chloride (10%), sodium chloride (5% w/v)and magnesium chloride (5% w/v). As used herein, all expressions of concentration using the designation "%w/v" shall mean percent weight per total volume of the preparation regardless of form, e.g., cream, tablet, liquid, unless specified otherwise.

The components of the base cream may be those commonly found in hand creams, such as water (20-80%w/v), mineral oil (3-18%w/v), glyceryl stearate (0.5-12%w/v), squalene(0.2-12%w/v), cetyl alcohol (0.1-11%w/v), propylene glycol stearate (0.1-11%w/v), wheat germ oil (0.1-6%w/v), glyceryl stearate (0.1-6%w/v), isopropyl myristate (0.1-6%w/v), stearyl stearate (0.1-6%w/v), polysorbate 60 (0.1-5%w/v), propylene glycol(0.05-5%w/v), tocopherol acetate (0.05-5%), collagen (0.05-5%), sorbitan stearate (0.05-5%), vitamin A&D (0.02-4%w/v), triethanolamine (0.01-4%w/v), methylparaben (0.01-4%w/v), aloe vera extract (0.01-4%w/v), imidazolidinyl urea (0.01-4%w/v), propylparaben (0.01-4%w/v), bha (0.01-4%w/v), L-arginine hydrocholide (0.25% to 25%w/v), sodium chloride (0.25% to 25%w/v), magnesium chloride (0.25% to 25%w/v).

L-arginine hydrochloride provides a precursor to the molecule, nitric oxide, NO. Nitric oxide is the substance that relaxes the blood vessels, allowing for increased blood flow. The concentration of the L-arginine-based compound, e.g., L-arginine hydrochloride, is preferably about between 0.25 to 25%w/v.

Choline chloride, sodium chloride and magnesium chloride are non-limiting examples of salts which provide a high ionic strength environment for the highly charged molecule, L-arginine. This high ionic strength environment is an example of a hostile biophysical environment for L-arginine. That is, the highly charged ionic strength provided by the salts to the L-arginine carrier is an unfavorable environment for the highly charged L-arginine which facilitates or promotes L-arginine migration out of the carrier

and into a more hospitable, less charged environment such as human tissue. The ionic strength is preferably any amount greater than two times the physiological ionic strength of blood.

The cream acts to promote healing of superficial ulcers such as those sometimes found on the legs of persons with severe diabetes. Application twice daily for a period of two weeks causes substantial healing and in many cases complete healing is achieved within this time period or slightly longer (3-4 weeks).

Thus, the topical delivery vehicle containing the nitric oxide releasing substance, choline chloride, sodium chloride and/or magnesium chloride is the agent which produces beneficial effects such as hair growth, healing of ulcers such as leg ulcers or restoration of normal erectile function in males suffering from erectile dysfunction. Another important embodiment of the present invention consists of a topical delivery vehicle as described above, wherein the vehicle also includes capsaicin (0.025%w/v) or oleoresin capsicum (0.5%w/v). The purpose of the capsaicin or oleoresin capsicum is to deplete sensory fibers of substance P (SP). The cream is the agent which is applied to human or mammalian tissue in order to aid in overcoming pain.

The treatment consists of applying the cream directly to the painful area. When carried out every four hours for a period of 12-16 hrs and then maintained with twice daily administration substantial relief from pain results.

THE USE OF AN ORAL DELIVERY VEHICLE IN CONJUNCTION WITH THE USE OF A TOPICAL DELIVERY VEHICLE

Another embodiment according to the present invention is the use of an oral delivery vehicle as described above in conjunction with the use of a topical delivery vehicle as described above. The use of both delivery vehicles in combination will effectively cause any of the beneficial effects cited above.

For example, a treatment consisting of oral administration of a nitric oxide releasing substance used in conjunction with the topical delivery

vehicle
containing the nitric oxide releasing substance, when carried out daily for a period of 7-10 days and then maintained with daily administration causes substantial relief from impotence in many men.

OTHER ACTIVE INGREDIENTS

While L-arginine hydrochloride is the preferred active agent for use as a nitric oxide releasing substance other agents could be used which are also precursors or donors of nitric oxide. Specifically, L-arginine hydrochloride is preferred due to the fact that it is a naturally occurring compound that is nontoxic, highly soluble and inexpensive. Other precursors which may be used include D,L -arginine, L-arginine, alkyl (ethyl, methyl, propyl, isopropyl, butyl, isobutyl, t-butyl) esters of L-arginine and salts thereof. Pharmaceutically acceptable salts include hydrochloride, glutamate, butyrate, and glycolate.

In the case of an alternative active agent were used it would be simply substituted for L-arginine in a delivery preparation and the preparation used as in the case of the L-arginine preparation. The cream may contain capsaicin or oleoresin capsicum in addition to L-arginine.

OTHER MEANS OF EFFECTING ABSORPTION

A variety of carriers for effecting absorption are possible. One approach to effectuate the absorption of a highly charged molecule such as L-arginine into tissue is to either create a biophysically hostile environment in the delivery vehicle such that L-arginine would prefer to be in tissue. Other approaches include packaging L-arginine in such a way that it is carried into tissue and/or neutralize its charge by derivatization or forming a neutral salt. Examples of biophysically hostile environments, include but are not limited to, high ionic strength, high or low pH and/or highly hydrophobic environments. Examples of packaging which would be carried into tissue include liposomes or emulsions of collagen, collagen peptides or other components of skin or basement

membrane. An example of neutralization of charge include the salt, arginine glutamate which is electronically neutral. Other acceptable arginine salts are set forth herein above.

In each case of creating a hostile biophysical environment for the active agent, the agent was added to an appropriate preparation. In the case of creating a high ionic strength ion environment, salts such as but not limited to sodium chloride, potassium chloride, choline chloride, lithium chloride, alone or in combination were added in high concentration to achieve an ionic strength greater than two times the physiological strength of blood. Other highly charged molecules such as polylysine, polyglutamine, polyaspartate or copolymers of such charged amino acids may be used to create the hostile biophysical environment.

Alternatively a hostile biophysical environment may be created by placing the highly charged L-arginine in an hydrophobic, oily environment such as in an oil-based cream containing little or no water. The preferred hydrophobicity or rho (ρ) is greater than two times the physiological hydrophobicity of blood. Absorption may further be aided by combining the use of hostile biophysical environments with the use of penetrating agents such as oleoresin capsicum or its constituents or molecules containing heterocyclic rings to which are attached hydrocarbon chains.

If a high or low pH environment is the hostile environment chosen, the preferred pH range is about between 3 to 11 pH.

CLINICAL APPLICATIONS

Example 1

In this example, a person with very cold fingers was provided with the above warming cream consisting of a delivery vehicle of penetrating cream, L-arginine hydrochloride (15% w/v), and sodium chloride (10% w/v). The surface temperature of the subject fingers of the left hand varied from 21°C to 24 °C . The warming cream was applied by rubbing it into the skin. Surface temperatures of each finger were measured at 15 minute intervals for the initial

hour. At the initial 15 minute interval following administration of the warming cream, an identifiable effect had begun to occur with surface temperatures of various fingers rising to 26°C to 29 °C. The maximal effect was reached by 45 minutes with surface temperatures of various fingers becoming 31°C to 34 °C. The effect was sustained for at least 4 hours.

Example 2

In this example a 53 year old man with baldness consisting of a severely receding hairline as well as a large "bald spot" on the top rear of his head was provided with a penetrating cream containing L-arginine hydrochloride (15% w/v) and sodium chloride (10% w/v). The cream was applied to the bald areas each night before going to bed and was rubbed in extensively for maximal absorption. New hair growth was noted within 2-3 weeks. Within 4 months the receding hairline (previously 4 cm of bald skin) had returned to normal and the "bald spot" previously more than 7 cm in diameter had been reduced to an area of less than 2 cm with even this area showing some new hair growth.

Example 3

In a 54 year old man with a history of impotence administration of 1.5 g L-arginine daily in the form of oral capsules combined with a twice daily administration of a penetrating cream containing L-arginine hydrochloride (15% w/v) and sodium chloride (10% w/v) directly to the penis for 7 days brought initial relief from the symptoms of impotence and allowed the subject to resume normal sexual activity. This relief of symptoms was maintained by continuation of the treatment on a daily basis.

Example 4

In a 52 year old woman with a 13 year history of chronic neck pain, administration of a penetrating cream containing L-arginine hydrochloride (12.5% w/v), choline chloride (10% w/v), magnesium chloride (5% w/v) and

sodium chloride (5% w/v) every four hours for 1 day followed by twice daily administration directly to the neck brought relief from the pain within the first day. This relief of symptoms was maintained by continuation of the twice daily treatment.

Example 5

In a 35 year old man with a three year history of shoulder pain, application of a penetrating cream containing L-arginine hydrochloride (12.5% w/v) and choline chloride (10% w/v), magnesium chloride (5%), sodium chloride (5%) and oleoresin capsicum (0.5%) every four hours for 1 day followed by twice daily applications directly to the painful area brought relief from pain within 8 hours. The relief of symptoms was maintained by continuation of twice daily treatment regimen.

Example 6

In this example, a 53 year old man with a scalp lacking sufficient hair consisting of a severely receding hairline as well as a large "bald spot" on the top rear of the head was provided with a penetrating cream containing L-arginine hydrochloride (12.5% w/v), choline chloride (10% w/v), sodium chloride (5% w/v) and magnesium chloride (5% w/v). The cream was applied to the bald areas each night before going to bed and was rubbed in extensively for maximal absorption. New hair growth was noted within 2-3 weeks. Within 4 months, the receding hairline (previously 4 cm of bald skin) had returned to normal and the "bald spot," previously more than 7 cm in diameter had been reduced to an area of less than 2 cm with some new hair growth in the 2 cm area.

Example 7

In a 54 year old man with a history of impotence, twice daily administration of a penetrating cream containing L-arginine hydrochloride (12.5% w/v), choline chloride (10% w/v), sodium chloride (10% w/v) and magnesium chloride (5%

w/v) directly to the penis twice daily for 7 days brought initial relief from the symptoms of impotence and allowed the subject to resume normal sexual activity. This relief of symptoms was maintained by continuation of the treatment daily.

Example 8

In a 62 year old man with a history of impotence, placement of a condom containing a water based penetrating cream containing L-arginine hydrochloride (12.5% w/v), choline chloride (10% w/v), sodium chloride (5% w/v) and magnesium chloride (5% w/v) on the man's flaccid penis for 30-60 minutes before erection was desired resulted in the formation of an erection when sexual performance was needed. The erection was easily obtained and normal sexual activity was conducted.

Example 9

In this example, a person (female, age 52) with very cold fingers was provided with the above warming cream consisting of a delivery vehicle of penetrating cream, L-arginine hydrochloride (12.5%), choline chloride (10%), magnesium chloride (5%) and sodium chloride (5%). The surface temperature of the subject fingers of the left hand varied from 21 to 24 C° . The warming cream was applied by rubbing it into the skin. Surface temperatures of each finger were measured at 15 minute intervals for the initial hour. At the initial 15 minute interval following administration of the warming cream, a noticeable effect had begun to occur with the surface temperatures or various fingers rising to between 26 to 29 C°. Maximal effect was reached by 45 minutes with surface temperatures of various fingers reaching 31 to 34 C°. The effect was sustained for at least 4 hours.

As illustrated by the examples, it can accordingly be seen that the present invention provides a method for administering a nitric oxide releasing substance in a delivery vehicle which when applied to cold, and often painful tissue, causes an increase in skin temperature through utilization of one of

the body's own mechanisms for producing warmth. This effect is achieved by providing at the local site, the biochemical substrate from which the controlling substance, nitric oxide, is produced. Nitric oxide causes increases in local blood flow which results in warming.

Further, it can be seen that the present invention provides a method for administering a nitric oxide releasing substance in a delivery vehicle which when applied to a person with impotence causes a reversal of impotence by use of the body's own mechanisms. This effect is achieved by providing the biochemical substrate at the local site from which the controlling substance, nitric oxide, is produced.

Still further, it can be seen that the present invention provides a method for administering a nitric oxide releasing substance in a delivery vehicle, which when applied to bald scalp causes hair growth through utilization of one of the body's own mechanisms. This effect is achieved by providing the biochemical substrate at the local site from which the controlling substance, nitric oxide is produced. Nitric oxide causes increases in local blood flow which enables the growth of hair.

Yet further it can be seen that the present invention provides a method for administering a nitric oxide releasing substance in a delivery vehicle which when applied to leg ulcers cause healing through use of the body's own mechanisms. Nitric oxide causes increases in local blood flow allowing the body's own healing cells and substances to reach the ulcer site.

Further, it can be seen that the present invention provides a method for administering a nitric oxide releasing substance in a delivery vehicle which, when applied to a person with pain, causes a reduction or cessation of pain by use of the body's own mechanisms. This effect is achieved by providing at the local site, the biochemical substrate from which the controlling substance, L-arginine, causes enhancement in levels of the natural analgesic kyotorphin and/or enhancement of the effectiveness of natural endorphins. Further, it is seen in the present invention when L-arginine is used in conjunction with capsaicin or oleoresin capsicum, an additional mechanism of pain relief, depletion of substance P from sensory

fibers is activated.

Although the description above contains many specificities, these should not be construed as limiting the scope of the invention but as merely providing illustrations of some of the presently preferred embodiments of this invention. Various other embodiments and ramifications are possible within this scope. Thus the scope of the invention should be determined by the appended claims and their legal equivalents, rather than by the examples given.

1. A method of delivering a nitric oxide releasing substance selected from the group consisting of L-arginine, L-arginine salts and L-arginine derivatives, to a selected area of skin comprising the step of topically applying to the skin a substance delivery vehicle containing an effective amount of the substance, and wherein said vehicle creates a hostile biophysical environment for the substance which causes the substance to migrate from the vehicle to the skin where the substance is absorbed.

2. The method of claim 1 wherein a vehicle selected from the group consisting of topical creams, topical liquids, topical lotions and topical ointments containing the substance and an ionic salt is applied to the skin.

3. The method of claim 1 wherein the vehicle is a hydrophobic delivery vehicle containing the substance and at least one liposome.

4. The method of claim 3 wherein the vehicle containing the substance and the at least one liposome is applied to the skin so that the at least one liposome migrate from the vehicle to the skin.

5. The method of claim 1 wherein the vehicle has a pH about 3-11pH.

6. The method of claim 1 wherein the delivery vehicle comprises water (20-80%w/v), mineral oil (3-18%w/v), glyceryl stearate (0.5-12%w/v), squalene(0.2-12%w/v), cetyl alcohol (0.1-11%w/v), propylene glycol stearate (0.1-11%w/v), wheat germ oil (0.1-6%w/v), glyceryl stearate (0.1-6%w/v), isopropyl myristate (0.1-6%w/v), stearyl stearate (0.1-6%w/v), polysorbate 60 (0.1-5%w/v), propylene glycol(0.05-5%w/v), tocopherol acetate (0.05-5%w/v), collagen (0.05-5%w/v), sorbitan stearate (0.05-5%w/v), vitamin A&D (0.02-4%w/v), triethanolamine (0.01-4%w/v), methylparaben (0.01-4%w/v), aloe

vera extract (0.01-4%w/v), imidazolidinyl urea (0.01-4%w/v), propylparaben (0.01-4%w/v), bha (0.01-4%w/v), L-arginine hydrochloride (0.25% to 25%w/v), sodium chloride (0.25% to 25%w/v), magnesium chloride (0.25% to 25%w/v).

7. The method of claim 6 wherein the delivery vehicle includes choline chloride (0.25-25%w/v).

8. The method of claim 6 wherein the delivery vehicle contains L-arginine glutamate (0.25-25%w/v) is.

9. A method of treating impotence in a male comprising delivering a nitric oxide releasing substance selected from a the group consisting of L-arginine, L-arginine salts and L-arginine derivatives, to the penis by topically applying to the penis delivery a vehicle containing an effective amount of the substance, wherein the vehicle creates a hostile biophyscial environment which causes the substance to migrate from the vehicle to the penis where the substance is absorbed.

10. The method of claim 9 wherein the vehicle selected from the group consisting of topical creams, topical liquids, topical lotions and topical ointments containing the substance.

11. The method of claim 9 wherein the delivery vehicle is a hydrophobic delivery vehicle containing the substance and at least one liposome.

12. The method of claim 11 wherein the vehicle containing the substance and liposome is applied to the penis so that the at least one liposome migrates from the vehicle to the penis.

13. The method of claim 9 wherein the delivery vehicle comprises water (20-80%w/v), mineral oil (3-18%w/v), glyceryl stearate [SE](0.5-12%w/v), squalene(0.2-12%w/v), cetyl alcohol (0.1-11%w/v), propylene glycol stearate [SE] (0.1-11%w/v), wheat germ oil (0.1-6%w/v), glyceryl stearate (0.1-6%w/v), isopropyl myristate (0.1-6%w/v), stearyl stearate (0.1-6%w/v), polysorbate 60 (0.1-5%w/v), propylene glycol(0.05-5%w/v), tocopherol acetate (0.05-5%w/v), collagen (0.05-5%w/v), sorbitan stearate (0.05-5%w/v), vitamin A&D (0.02-4%w/v), triethanolamine (0.01-4%w/v), methylparaben (0.01-4%w/v), aloe vera extract (0.01-4%w/v), imidazolidinyl urea (0.01-4%w/v), propylparaben (0.01-4%w/v), bha (0.01-4%w/v), L-arginine hydrochloride (0.25% to 25%w/v), sodium chloride (0.25% to 25%w/v), magnesium chloride (0.25% to 25%w/v).

14. The method of claim 13 wherein the delivery vehicle comprises choline chloride (0.25-25%w/v) is.

15. The method of claim 13 wherein the delivery vehicle contains L-arginine glutamate (0.25-25%w/v).

16. The method according to claim 9 wherein the delivery vehicle is contained in a condom which is placed on the penis.

17. A method of promoting hair growth comprising delivering a nitric oxide releasing substance selected from the group consisting of L-arginine, L-arginine salts and L-arginine derivatives, by topically applying to the selected area of skin where hair growth is desired a delivery vehicle containing an effective amount of the substance, wherein the delivery vehicle creates a hostile biophysical environment which causes the substance to migrate from the vehicle to the selected area of skin where the substance is absorbed.

18. The method of claim 17 wherein the vehicle selected from the group consisting of topical creams, topical liquids, topical lotions and topical ointments containing the substance.

19. The method of claim 17 wherein the delivery vehicle is a hydrophobic delivery vehicle containing the substance and at least one liposome.

20. The method of claim 19 wherein the vehicle containing the substance and at least one liposome is applied to the selected area of skin so that the liposomes migrate from the vehicle to the skin where hair growth is desired.

21. The method of claim 17 wherein the delivery vehicle comprises water (20-80%w/v), mineral oil (3-18%w/v), glyceryl stearate [SE](0.5-12%w/v), squalene(0.2-12%w/v), cetyl alcohol (0.1-11%w/v), propylene glycol stearate [SE] (0.1-11%w/v), wheat germ oil (0.1-6%w/v), glyceryl stearate (0.1-6%w/v), isopropyl myristate (0.1-6%w/v), stearyl stearate (0.1-6%w/v), polysorbate 60 (0.1-5%w/v), propylene glycol(0.05-5%w/v), tocopherol acetate (0.05-5%w/v), collagen (0.05-5%w/v), sorbitan stearate (0.05-5%w/v), vitamin A&D (0.02-4%w/v), triethanolamine (0.01-4%w/v), methylparaben (0.01-4%w/v), aloe vera extract (0.01-4%w/v), imidazolidinyl urea (0.01-4%w/v), propylparaben (0.01-4%w/v), bha (0.01-4%w/v), L-arginine hydrochloride (0.25% to 25%w/v), sodium chloride (0.25% to 25%w/v), magnesium chloride (0.25% to 25%w/v).

22. The method of claim 21 wherein a delivery vehicle comprising choline chloride (0.25-25%w/v) is applied to the selected area of skin where hair growth is desired.

23. The method of claim 21 wherein a delivery vehicle also comprising L-arginine glutamate (0.25-25%w/v) is applied to the selected area of skin where hair growth is desired.

24. The method of claim 17 wherein a transdermal patch containing the substance and the ionic salt in a concentration sufficient to create an ionic strength environment so that the substance migrates from the patch to the selected area of skin is applied where hair growth is desired.

25. A method of promoting hair growth by delivering a nitric oxide releasing substance selected from a member of the group consisting of L-arginine, L-arginine salts and L-arginine derivatives comprising the step of orally administering to the body a vehicle containing an effective amount of the substance and a concentration of sodium chloride sufficient to create an ionic environment which causes the substance to be absorbed by the surrounding tissue.

26. The method of claim 25 wherein the vehicle is selected from the group consisting of orally administered capsules, orally administered tablets, and orally administered liquids containing the substance is orally administered to the body.

27. The method of claim 25 wherein the oral delivery vehicle containing the substance is orally administered in conjunction with the step of topically applying a delivery vehicle containing the substance and a concentration of ionic salt sufficient to create an ionic strength environment which causes the substance to migrate from the topical delivery vehicle to the selected area of skin where hair growth is desired.

28. The method of claim 27 wherein an oral delivery vehicle comprising L-arginine (0.5-30g/day) is orally administered in conjunction with a topical delivery vehicle comprising water (20-80%w/v), mineral oil (3-

18%w/v), glyceryl stearate [SE](0.5-12%w/v), squalene(0.2-12%w/v), cetyl alcohol (0.1-11%w/v), propylene glycol stearate [SE] (0.1-11%w/v), wheat germ oil (0.1-6%w/v), glyceryl stearate (0.1-6%w/v), isopropyl myristate (0.1-6%w/v), stearyl stearate (0.1-6%w/v), polysorbate 60 (0.1-5%w/v), propylene glycol(0.05-5%w/v), tocopherol acetate (0.05-5%w/v), collagen (0.05-5%w/v), sorbitan stearate (0.05-5%w/v), vitamin A&D (0.02-4%w/v), triethanolamine (0.01-4%w/v), methylparaben (0.01-4%w/v), aloe vera extract (0.01-4%w/v), imidazolidinyl urea (0.01-4%w/v), propylparaben (0.01-4%w/v), bha (0.01-4%w/v), L-arginine hydrochloride (0.25% to 25%w/v), sodium chloride (0.25% to 25%w/v), magnesium chloride (0.25% to 25%w/v) is applied to the selected area of skin.

29. A method of increasing local blood flow by delivering a nitric oxide releasing substance selected from a member of the group consisting of L-arginine, L-arginine salts and L-arginine derivatives comprising the step of orally administering to the body a vehicle containing an effective amount of the substance and a concentration of sodium chloride sufficient to create an ionic environment which causes the substance to be absorbed by the surrounding tissue.

30. The method of claim 29 wherein the oral delivery vehicle is selected from the group consisting of orally administered capsules, orally administered tablets, and orally administered liquids containing the substance is orally administered to the body.

31. The method of claim 29 wherein an oral delivery vehicle comprising L-arginine in the range of 0.5-30g/day is orally administered.

32. A method of increasing local blood flow by delivering a nitric oxide releasing substance selected from a member of the group consisting of L-arginine, L-arginine salts and L-arginine derivatives comprising the step of

orally administering to the body a vehicle containing an effective amount of the substance and a concentration of sodium chloride sufficient to create an ionic environment which allows the substance to be absorbed by the surrounding tissue in conjunction with the step of topically applying a delivery vehicle containing the substance and a concentration of ionic salt sufficient to create an environment which causes the substance to migrate from the vehicle to the selected area of skin where the substance is absorbed.

33. The method of claim 32 wherein the topical delivery vehicle is selected from the group consisting of topical creams, topical liquids, topical lotions and topical ointments.

34. The method of claim 32 wherein a topical hydrophobic delivery vehicle containing the substance and the ionic salt is applied to the skin.

35. The method of claim 32 wherein a topical delivery vehicle containing the substance and an ionic salt concentration sufficient to create an ionic strength environment within the liposome is applied to the skin so that the liposomes migrate from the vehicle to the skin where the substance is absorbed.

36. The method of claim 32 wherein a transdermal patch containing the substance and the ionic salt is applied to the skin.

37. The method of claim 32 wherein an oral delivery vehicle comprising L-arginine (0.5-30g/day) is orally administered in conjunction with a topical delivery vehicle comprising water (20-80%w/v), mineral oil (3-18%w/v), glyceryl stearate [SE](0.5-12%w/v), squalene(0.2-12%w/v), cetyl alcohol (0.1-11%w/v), propylene glycol stearate [SE] (0.1-11%w/v), wheat germ oil (0.1-6%w/v), glyceryl stearate (0.1-6%w/v), isopropyl myristate (0.1-6%w/v), stearyl stearate (0.1-6%w/v), polysorbate 60 (0.1-5%w/v), propylene

glycol(0.05-5%w/v), tocopherol acetate (0.05-5%w/v), collagen (0.05-5%w/v), sorbitan stearate (0.05-5%w/v), vitamin A&D (0.02-4%w/v), triethanolamine (0.01-4%w/v), methylparaben (0.01-4%w/v), aloe vera extract (0.01-4%w/v), imidazolidinyl urea (0.01-4%w/v), propylparaben (0.01-4%w/v), bha (0.01-4%w/v), L-arginine hydrochloride (0.25% to 25%w/v), sodium chloride (0.25% to 25%w/v), magnesium chloride (0.25% to 25%w/v) is applied to the skin.

38. The method of claim 37 wherein a topical delivery vehicle also including choline chloride (0.25-25%w/v) is applied to the skin.

39. The method of claim 37 wherein a topical delivery vehicle containing L-arginine glutamate (0.25-25%w/v) is applied to the skin.

40. A method of warming cool or cold tissue by delivering a nitric oxide releasing substance selected from a member of the group consisting of L-arginine, L-arginine salts and L-arginine derivatives comprising the step of orally administering a vehicle containing an effective amount of the substance and a concentration of sodium chloride sufficient to create an ionic environment which causes the substance to be absorbed by the surrounding tissue.

41. The method of claim 40 wherein the oral delivery vehicle is selected from the group consisting of orally administered capsules, orally administered tablets, and orally administered liquids containing the substance is orally administered to the body.

42. The method of claim 40 wherein an oral delivery vehicle containing the substance is orally administered in conjunction with the step of topically applying a delivery vehicle containing the substance and a concentration of ionic salt sufficient to create an environment which causes

the substance to migrate from the vehicle to the selected area of skin where the substance is absorbed.

43. The method of claim 40 wherein the topical delivery vehicle is selected from the group consisting of topical creams, topical liquids, topical lotions and topical ointments.

44. The method of claim 40 wherein a topical hydrophobic delivery vehicle containing the substance and the ionic salt is applied to the skin.

45. The method of claim 40 wherein a topical delivery vehicle containing the substance and the ionic salt within a liposome is applied to the skin.

46. The method of claim 40 wherein a topical delivery vehicle containing the substance and an ionic salt concentration sufficient to create an ionic strength environment within the liposome is applied to the skin so that the liposomes migrate from the vehicle to the skin where the substance is absorbed.

47. The method of claim 40 wherein a transdermal patch containing the substance and the ionic salt is applied to the skin.

48. The method of claim 40 wherein an oral delivery vehicle comprising L-arginine (0.5-30g/day) is orally administered in conjunction with a topical delivery vehicle comprising water (20-80%w/v), mineral oil (3-18%w/v), glyceryl stearate [SE](0.5-12%w/v), squalene(0.2-12%w/v), cetyl alcohol (0.1-11%w/v), propylene glycol stearate [SE] (0.1-11%w/v), wheat germ oil (0.1-6%w/v), glyceryl stearate (0.1-6%w/v), isopropyl myristate (0.1-6%w/v), stearyl stearate (0.1-6%w/v), polysorbate 60 (0.1-5%w/v), propylene glycol(0.05-5%w/v), tocopherol acetate (0.05-5%w/v), collagen (0.05-5%w/v),

sorbitan stearate (0.05-5%w/v), vitamin A&D (0.02-4%w/v), triethanolamine (0.01-4%w/v), methylparaben (0.01-4%w/v), aloe vera extract (0.01-4%w/v), imidazolidinyl urea (0.01-4%w/v), propylparaben (0.01-4%w/v), bha (0.01-4%w/v), L-arginine hydrochloride (0.25% to 25%w/v), sodium chloride (0.25% to 25%w/v), magnesium chloride (0.25% to 25%w/v) is applied to the skin.

49. The method of claim 48 wherein a delivery vehicle also including choline chloride (0.25-25%w/v) is applied to the skin.

50. The method of claim 49 wherein a delivery vehicle containing L-arginine glutamate (0.25-25%w/v) is applied to the skin.

51. A method of warming tissue comprising delivering a nitric oxide releasing substance selected from a member of the group consisting of L-arginine, L-arginine salts and L-arginine derivatives, to skin comprising the step of topically applying to the skin a vehicle containing an effective amount of the substance, and a concentration of ionic salt sufficient to create an ionic environment which causes the substance to migrate from the vehicle to the skin where the substance is absorbed.

52. The method of claim 51 wherein a topical delivery vehicle selected from the group consisting of topical creams, topical liquids, topical lotions and topical ointments containing the substance and the ionic salt is applied to the skin.

53. The method of claim 51 wherein a hydrophobic delivery vehicle containing the substance and the ionic salt is applied to the skin.

54. The method of claim 51 wherein a vehicle containing the substance and the ionic salt within a liposome, and the is applied to the skin.

55. The method of claim 51 wherein a vehicle containing the substance and the ionic salt within a liposome and an ionic salt concentration sufficient to create an ionic strength environment within the liposome is applied to the skin so that the liposomes migrate from the vehicle to the skin.

56. The method of claim 51 wherein a transdermal patch containing the substance and the ionic salt is applied to the skin.

57. The method of claim 51 wherein a delivery vehicle comprising water (20-80%w/v), mineral oil (3-18%w/v), glyceryl stearate (0.25-12%w/v), squalene(0.25-12%w/v), cetyl alcohol (0.1-11%w/v), propylene glycol stearate (0.1-11%w/v), wheat germ oil (0.1-6%w/v), polysorbate 60 (0.1-5%w/v), propylene glycol (0.05-5%w/v), collagen (0.05-5%w/v), sorbitan stearate (0.05-5%w/v), vitamin A&D (0.02-4%w/v), vitamin E (0.02-4%w/v), triethanolamine (0.01-4%w/v), methylparaben (0.01-4%w/v), aloe vera extract (0.01-4%w/v), imidazolidinyl urea (0.01-4%w/v), propylparaben (0.01-4%w/v), bha (0.01-4%w/v), L-arginine hydrochloride (0.25% to 25%w/v), sodium chloride (0.25% to 25%w/v), the substance and the P depleting agent is applied to the skin.

58. The method of claim 57 wherein a delivery vehicle further comprising choline chloride (0.25-25%w/v) is applied to the skin.

59. The method of claim 57 wherein a delivery vehicle further comprising L-arginine glutamate (0.25-25%w/v) is applied to the skin.

60. A method of healing superficial ulcers by delivering a nitric oxide releasing substance selected from a member of the group consisting of L- arginine, L-arginine salts and L-arginine derivatives comprising the step of orally administering to the body a vehicle containing an effective amount of the substance and a concentration of sodium chloride sufficient to

create an ionic environment which causes the substance to be absorbed by the ulcer and the area surrounding the ulcer.

61. The method of claim 60 wherein the vehicle is selected from the group consisting of orally administered capsules, orally administered tablets, and orally administered liquids containing the substance is orally administered to the body.

62. The method of claim 60 wherein an oral delivery vehicle is orally administered in conjunction with the step of topically applying a delivery vehicle containing the substance and a concentration of ionic salt sufficient to create an environment which causes the substance to migrate from the vehicle to the ulcer and the area surrounding the ulcer.

63. The method of claim 62 wherein the delivery vehicle is selected from the group consisting of topical creams, topical liquids, topical lotions and topical ointments.

64. The method of claim 62 wherein a topical hydrophobic delivery vehicle containing the substance and the ionic salt is applied to the to the ulcer and the area surrounding the ulcer.

65. The method of claim 62 wherein a topical delivery vehicle containing the substance within a liposome and an ionic salt concentration sufficient to create an ionic strength environment within the liposome is applied to the skin so that the liposomes migrate from the vehicle to the to the ulcer and the area surrounding the ulcer.

66. The method of claim 62 wherein a transdermal patch containing the substance and the ionic salt is applied to the to the ulcer and the area surrounding the ulcer.

67. The method of claim 62 wherein an oral delivery vehicle comprising L-arginine (0.5-30g/day) is orally administered in conjunction with a topical delivery vehicle comprising water (20-80%w/v), mineral oil (3-18%w/v), glyceryl stearate [SE](0.5-12%w/v), squalene(0.2-12%w/v), cetyl alcohol (0.1-11%w/v), propylene glycol stearate [SE] (0.1-11%w/v), wheat germ oil (0.1-6%w/v), glyceryl stearate (0.1-6%w/v), isopropyl myristate (0.1-6%w/v), stearyl stearate (0.1-6%w/v), polysorbate 60 (0.1-5%w/v), propylene glycol(0.05-5%w/v), tocopherol acetate (0.05-5%w/v), collagen (0.05-5%w/v), sorbitan stearate (0.05-5%w/v), vitamin A&D (0.02-4%w/v), triethanolamine (0.01-4%w/v), methylparaben (0.01-4%w/v), aloe vera extract (0.01-4%w/v), imidazolidinyl urea (0.01-4%w/v), propylparaben (0.01-4%w/v), bha (0.01-4%w/v), L-arginine hydrochloride (0.25% to 25%w/v), sodium chloride (0.25% to 25%w/v), magnesium chloride (0.25% to 25%w/v) is applied to the to the ulcer and the area surrounding the ulcer.

68. The method of claim 67 wherein a delivery vehicle also including choline chloride (0.25-25%w/v) is applied to the to the ulcer and the area surrounding the ulcer.

69. The method of claim 67 wherein a delivery vehicle containing L-arginine glutamate (0.25-25%w/v) is applied to the to the ulcer and the area surrounding the ulcer.

70. A method of overcoming pain comprising delivering a kyotorphin releasing substance selected from a member of the group consisting of L-arginine, L-arginine salts and L-arginine derivatives, to skin comprising the step of topically applying to the skin a vehicle containing an effective amount of the substance, and a concentration of ionic salt sufficient to create an ionic environment which causes the substance to migrate from the vehicle to the skin where the substance is absorbed in conjunction with delivering a P

depleting agent selected from a member of the group consisting of capsaicin and oleoresin to the skin.

71. The method of claim 70 wherein a topical delivery vehicle selected from the group consisting of topical creams, topical liquids, topical lotions and topical ointments containing the substance, the ionic salt and the P depleting agent is applied to the skin.

72. The method of claim 70 wherein a hydrophobic delivery vehicle containing the substance, the ionic salt and the P depleting agent is applied to the skin.

73. The method of claim 70 wherein a vehicle containing the substance and the P depleting agent within a liposome and an ionic salt concentration sufficient to create an ionic strength environment within the liposome is applied to the skin so that the liposomes migrate from the vehicle to the skin.

74. The method of claim 70 wherein a transdermal patch containing the substance, the ionic salt and the P depleting agent is applied to the skin.

75. The method of claim 70 wherein a delivery vehicle comprising water (20-80%w/v), mineral oil (3-18%w/v), glyceryl stearate (0.25-12%w/v), squalene(0.25-12%w/v), cetyl alcohol (0.1-11%w/v), propylene glycol stearate (0.1-11%w/v), wheat germ oil (0.1-6%w/v), polysorbate 60 (0.1-5%w/v), propylene glycol (0.05-5%w/v), collagen (0.05-5%w/v), sorbitan stearate (0.05-5%w/v), vitamin A&D (0.02-4%w/v), vitamin E (0.02-4%w/v), triethanolamine (0.01-4%w/v), methylparaben (0.01-4%w/v), aloe vera extract (0.01-4%w/v), imidazolidinyl urea (0.01-4%w/v), propylparaben (0.01-4%w/v), bha (0.01-4%w/v), L-arginine hydrochloride (0.25% to 25%w/v), sodium

chloride (0.25% to 25%w/v), the substance and the P depleting agent is applied to the skin.

76. The method of claim 70 wherein a delivery vehicle consists of capsaicin as a P depleting agent in the range from 0.005 to 0.5% w/v.

77. The method of claim 70 wherein a delivery vehicle consists of oleoresin as a P depleting agent in the range from 0.05 to 2.5% w/v.

78. A composition for increasing blood flow comprising:

a nitric oxide releasing substance selected from the group consisting of L-arginine, L-arginine salts and L-arginine derivatives; and,

a substance delivery carrier comprising a concentration of ionic salt sufficient to create an ionic environment which causes the substance to migrate from the carrier to human skin when the composition is applied to skin.

79. The composition of claim 78 wherein the substance delivery carrier further comprises water (20-80%w/v), mineral oil (3-18%w/v), glyceryl stearate (0.25-12%w/v), squalene(0.25-12%w/v), cetyl alcohol (0.1-11%w/v), propylene glycol stearate (0.1-11%w/v), wheat germ oil (0.1-6%w/v), polysorbate 60 (0.1-5%w/v), propylene glycol (0.05-5%w/v), collagen (0.05-5%w/v), sorbitan stearate (0.05-5%w/v), vitamin A&D (0.02-4%w/v), vitamin E (0.02-4%w/v), triethanolamine (0.01-4%w/v), methylparaben (0.01-4%w/v), aloe vera extract (0.01-4%w/v), imidazolidinyl urea (0.01-4%w/v), propylparaben (0.01-4%w/v), bha (0.01-4%w/v), L-arginine hydrochloride (0.25% to 25%w/v) and sodium chloride (0.25% to 25%w/v).

80. The composition of claim 78 wherein the ionic salt is selected from the group consisting of choline chloride, sodium chloride, magnesium chloride and mixtures thereof.

81. The composition of claim 80 wherein the ionic salt has an ionic strength greater than two times the physiological ionic strength of blood.

82. The composition of claim 78 wherein the nitric oxide releasing substance has a concentration of about between 0.25 to 25% w/v.

83. A composition for increasing blood flow comprising:
about 12.5%w/v L-arginine hydrochloride;
about 10.0%w/v choline chloride;
about 5%w/v sodium chloride;
about 5%w/v magnesium chloride; and,
a topical delivery vehicle.

84. The composition of claim 83 wherein the topical delivery vehicle comprises:

water (20-80%w/v), mineral oil (3-18%w/v), glyceryl stearate (0.25-12%w/v), squalene(0.25-12%w/v), cetyl alcohol (0.1-11%w/v), propylene glycol stearate (0.1-11%w/v), wheat germ oil (0.1-6%w/v), polysorbate 60 (0.1-5%w/v), propylene glycol (0.05-5%w/v), collagen (0.05-5%w/v), sorbitan stearate (0.05-5%w/v), vitamin A&D (0.02-4%w/v), vitamin E (0.02-4%w/v), triethanolamine (0.01-4%w/v), methylparaben (0.01-4%w/v), aloe vera extract (0.01-4%w/v), imidazolidinyl urea (0.01-4%w/v), propylparaben (0.01-4%w/v), bha (0.01-4%w/v), L-arginine hydrochloride (0.25% to 25%w/v) and sodium chloride (0.25% to 25%w/v).

85. The composition of claim 83 wherein the composition has a pH of about between 3 to 11 pH.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US98/19429

A. CLASSIFICATION OF SUBJECT MATTER
IPC(6) : A01N 37/20
US CL. : 514/310, 478, 479; 424/718
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 514/310, 478, 479; 424/718

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

none

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

none

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,595,753 A (HECHTMAN) 21 January 1997, patent claim 6, paragraph bridging col. 1 and 2.	1, 2, 6, 29, 32-35, 40-44, 47, 48, 52-53, 55, 78-82
X	US 5,629,002 A (WEUFFEN et al.) 13 May 1997, see Example 10.	1, 2, 5, 6, 17-19, 21, 25, 27, 28, 29, 32-37, 40-44, 47, 48, 51-53, 55, 78-82

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance		
"E"	earlier document published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed	"&"	document member of the same patent family

Date of the actual completion of the international search 07 DECEMBER 1998	Date of mailing of the international search report 11 JAN 1999
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Form PCT/ISA/210 (second sheet)(July 1992)*

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WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :
A01N 37/20

A1

(11) International Publication Number: WO 99/13717

(43) International Publication Date: 25 March 1999 (25.03.99)

(21) International Application Number: PCT/US98/19429

(22) International Filing Date: 17 September 1998 (17.09.98)

(30) Priority Data:

08/932,227	17 September 1997 (17.09.97)	US
08/932,595	17 September 1997 (17.09.97)	US
08/936,188	17 September 1997 (17.09.97)	US
08/936,189	17 September 1997 (17.09.97)	US

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(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.
With amended claims.

Date of publication of the amended claims:
22 April 1999 (22.04.99)

(54) Title: A DELIVERY OF ARGININE TO CAUSE BENEFICIAL EFFECTS

(57) Abstract

A delivery vehicle and method for delivering, either topically or orally, a nitric oxide releasing substance such as L-arginine 31 into human or mammalian tissue for the purpose of producing beneficial effects such as the relief of pain, the warming of cold tissues, the growth of hair on the scalp, the healing of leg ulcers, the relief of impotence as well as other beneficial effects. The delivery vehicle provides a hostile biophysical environment which facilitates and promotes the migration of the nitric oxide releasing substance into the tissue.

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AMENDED CLAIMS

[received by the International Bureau on 5 March 1999 (05.03.99); original claims 51-54 and 67-85 replaced by amended claims 51-54 and 67-87; remaining claims unchanged (6 pages)]

sorbitan stearate (0.05-5%w/v), vitamin A&D (0.02-4%w/v), triethanolamine (0.01-4%w/v), methylparaben (0.01-4%w/v), aloe vera extract (0.01-4%w/v), imidazolidinyl urea (0.01-4%w/v), propylparaben (0.01-4%w/v), bha (0.01-4%w/v), L-arginine hydrochloride (0.25% to 25%w/v), sodium chloride (0.25% to 25%w/v), magnesium chloride (0.25% to 25%w/v) is applied to the skin.

49. The method of claim 48 wherein a delivery vehicle also including choline chloride (0.25-25%w/v) is applied to the skin.

50. The method of claim 49 wherein a delivery vehicle containing L-arginine glutamate (0.25-25%w/v) is applied to the skin.

51. A method of warming tissue comprising delivering a nitric oxide releasing substance selected from a member of the group consisting of L-arginine, L-arginine salts and L-arginine derivatives, to skin comprising the step of topically applying to the skin a vehicle containing an effective amount of the substance, and a concentration of ionic salt sufficient to create an ionic environment which causes the substance to migrate from the vehicle to the skin where the substance is absorbed.

52. The method of claim 51 wherein a topical delivery vehicle selected from the group consisting of topical creams, topical liquids, topical lotions and topical ointments containing the substance and the ionic salt is applied to the skin.

53. The method of claim 51 wherein a hydrophobic delivery vehicle containing the substance and the ionic salt is applied to the skin.

54. The method of claim 51 wherein a vehicle containing the substance and the ionic salt within a liposome is applied to the skin.

67. The method of claim 62 wherein an oral delivery vehicle comprising L-arginine (0.5-30g/day) is orally administered in conjunction with a topical delivery vehicle comprising water (20-80%w/v), mineral oil (3-18%w/v), glyceryl stearate [SE](0.5-12%w/v), squalene(0.2-12%w/v), cetyl alcohol (0.1-11%w/v), propylene glycol stearate [SE] (0.1-11%w/v), wheat germ oil (0.1-6%w/v), glyceryl stearate (0.1-6%w/v), isopropyl myristate (0.1-6%w/v), stearyl stearate (0.1-6%w/v), polysorbate 60 (0.1-5%w/v), propylene glycol(0.05-5%w/v), tocopherol acetate (0.05-5%w/v), collagen (0.05-5%w/v), sorbitan stearate (0.05-5%w/v), vitamin A&D (0.02-4%w/v), triethanolamine (0.01-4%w/v), methylparaben (0.01-4%w/v), aloe vera extract (0.01-4%w/v), imidazolidinyl urea (0.01-4%w/v), propylparaben (0.01-4%w/v), bha (0.01-4%w/v), L-arginine hydrochloride (0.25% to 25%w/v), sodium chloride (0.25% to 25%w/v), magnesium chloride (0.25% to 25%w/v) is applied to the to the ulcer and the area surrounding the ulcer.

68. The method of claim 67 wherein a delivery vehicle also including choline chloride (0.25-25%w/v) is applied to the to the ulcer and the area surrounding the ulcer.

69. The method of claim 67 wherein a delivery vehicle containing L-arginine glutamate (0.25-25%w/v) is applied to the to the ulcer and the area surrounding the ulcer.

70. A method of overcoming pain comprising delivering a kyotorphin releasing substance selected from a member of the group consisting of L-arginine, L-arginine salts and L-arginine derivatives, to skin comprising the step of topically applying to the skin a vehicle containing an effective amount of the substance, and a concentration of ionic salt sufficient to create an ionic environment which causes the substance to migrate from the vehicle to the skin where the substance is absorbed in conjunction with delivering a P

depleting agent selected from a member of the group consisting of capsaicin and oleoresin to the skin.

71. The method of claim 70 wherein a topical delivery vehicle selected from the group consisting of topical creams, topical liquids, topical lotions and topical ointments containing the substance, the ionic salt and the P depleting agent is applied to the skin.

72. The method of claim 70 wherein a hydrophobic delivery vehicle containing the substance, the ionic salt and the P depleting agent is applied to the skin.

73. The method of claim 70 wherein a vehicle containing the substance and the P depleting agent within a liposome and the ionic salt is applied to the skin.

74. The method of claim 70 wherein a vehicle containing the substance and the P depleting agent within a liposome and an ionic salt concentration sufficient to create an ionic strength environment within the liposome is applied to the skin so that the liposomes migrate from the vehicle to the skin.

75. The method according to claims 70-74 wherein the delivery vehicle, the substance and the P depleting agent is contained in a condom which is placed on the penis.

76. The method of claim 70 wherein a transdermal patch containing the substance, the ionic salt and the P depleting agent is applied to the skin.

77. The method of claim 70 wherein a delivery vehicle comprising water (20-80%w/v), mineral oil (3-18%w/v), glyceryl stearate (0.25-12%w/v),

squalene(0.25-12%w/v), cetyl alcohol (0.1-11%w/v), propylene glycol stearate (0.1-11%w/v), wheat germ oil (0.1-6%w/v), polysorbate 60 (0.1-5%w/v), propylene glycol (0.05-5%w/v), collagen (0.05-5%w/v), sorbitan stearate (0.05-5%w/v), vitamin A&D (0.02-4%w/v), vitamin E (0.02-4%w/v), triethanolamine (0.01-4%w/v), methylparaben (0.01-4%w/v), aloe vera extract (0.01-4%w/v), imidazolidinyl urea (0.01-4%w/v), propylparaben (0.01-4%w/v), bha (0.01-4%w/v), L-arginine hydrochloride (0.25% to 25%w/v), sodium chloride (0.25% to 25%w/v), the substance and the P depleting agent is applied to the skin.

78. The method of claim 70 wherein a delivery vehicle consists of capsaicin as a P depleting agent in the range from 0.005 to 0.5% w/v.

79. The method of claim 70 wherein a delivery vehicle consists of oleoresin as a P depleting agent in the range from 0.05 to 2.5% w/v.

80. A composition for increasing blood flow comprising:

a nitric oxide releasing substance selected from the group consisting of L-arginine, L-arginine salts and L-arginine derivatives; and,

a substance delivery carrier comprising a concentration of ionic salt sufficient to create an ionic environment which causes the substance to migrate from the carrier to human skin when the composition is applied to skin.

81. The composition of claim 80 wherein the substance delivery carrier further comprises water (20-80%w/v), mineral oil (3-18%w/v), glyceryl stearate (0.25-12%w/v), squalene(0.25-12%w/v), cetyl alcohol (0.1-11%w/v), propylene glycol stearate (0.1-11%w/v), wheat germ oil (0.1-6%w/v), polysorbate 60 (0.1-5%w/v), propylene glycol (0.05-5%w/v), collagen (0.05-5%w/v), sorbitan stearate (0.05-5%w/v), vitamin A&D (0.02-4%w/v), vitamin E (0.02-4%w/v), triethanolamine (0.01-4%w/v), methylparaben (0.01-4%w/v),

aloe vera extract (0.01-4%w/v), imidazolidinyl urea (0.01-4%w/v), propylparaben (0.01-4%w/v), bha (0.01-4%w/v), L-arginine hydrochloride (0.25% to 25%w/v) and sodium chloride (0.25% to 25%w/v).

82. The composition of claim 80 wherein the ionic salt is selected from the group consisting of choline chloride, sodium chloride, magnesium chloride and mixtures thereof.

83. The composition of claim 82 wherein the ionic salt has an ionic strength greater than two times the physiological ionic strength of blood.

84. The composition of claim 80 wherein the nitric oxide releasing substance has a concentration of about between 0.25 to 25% w/v.

85. A composition for increasing blood flow comprising:
about 12.5%w/v L-arginine hydrochloride;
about 10.0%w/v choline chloride;
about 5%w/v sodium chloride;
about 5%w/v magnesium chloride; and,
a topical delivery vehicle.

86. The composition of claim 85 wherein the topical delivery vehicle comprises:

water (20-80%w/v), mineral oil (3-18%w/v), glyceryl stearate (0.25-12%w/v), squalene(0.25-12%w/v), cetyl alcohol (0.1-11%w/v), propylene glycol stearate (0.1-11%w/v), wheat germ oil (0.1-6%w/v), polysorbate 60 (0.1-5%w/v), propylene glycol (0.05-5%w/v), collagen (0.05-5%w/v), sorbitan stearate (0.05-5%w/v), vitamin A&D (0.02-4%w/v), vitamin E (0.02-4%w/v), triethanolamine (0.01-4%w/v), methylparaben (0.01-4%w/v), aloe vera extract (0.01-4%w/v), imidazolidinyl urea (0.01-4%w/v), propylparaben (0.01-4%w/v),

bha (0.01-4%w/v), L-arginine hydrochloride (0.25% to 25%w/v) and sodium chloride (0.25% to 25%w/v).

87. The composition of claim 85 wherein the composition has a pH of about between 3 to 11 pH.